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## Laser Spectroscopic Studies in the Gas Phase and Levitated Droplets

In this talk, ortho-substituted phenols, such as 2-aminophenol (2-AP), 2-hydroxyformanilide (2-HFA), and 2-acetaminophenol (2-AAP), cooled down in the molecular beam by the supersonic jet expansion, were investigated with the combination of quantum chemistry calculations and various laser spectroscopic techniques, such as mass-selected one-color resonance two-photon ionization, UV-UV hole-burning, and IR-dip spectroscopy. Gas-phase laser spectroscopy with nanosecond lasers is limited to the conformational landscape of specific isomers having sufficiently long excited-state lifetimes.[1] The proposed method addresses this problem by introducing infrared-induced isomerization of invisible isomers. The molecules of interest (2-AAP, 2-HFA, and 2-AP) have several isomers whose ortho-substituted isomers have a strong hydrogen bond and are absent in the resonant two-photon ionization spectrum, while the other isomers are visible. Intramolecular vibrational energy redistribution is induced by infrared excitation, which isomerizes the invisible isomers to visible isomers and causes the population gain in the visible isomers to be reflected in the gain peaks of IR-dip spectra. The ability to observe isomers with short lifetimes in the gas phase extends the capabilities of laser spectroscopy for further structural analysis.

The second part of this talk is focused on studies in levitated droplets. The theory of levitation is well understood, and the experimental technique has been used in various applications.[2] Intense sound waves produced by an ultrasonic radiator reflect from a solid plate to generate a standing wave. The sound waves produce acoustic radiation pressure on the particle, which counteracts the gravitational force. Particles are therefore levitated slightly below the pressure nodes of the ultrasonic standing wave. Levitation can avoid the complicating effects of a contacting surface and permits the so-called container-less processing of a single, levitated particle. I will briefly introduce previously reported levitated droplet studies and current study progress in my lab.

### References

- [1] Myong Yong Choi & Roger E. Miller, Four Tautomers of Isolated Guanine from Infrared Laser Spectroscopy in Helium Nanodroplets, *J. Am. Chem. Soc.*, **2006**, *128*, 7320-7328.
- [2] Michael Lucas, Stephen J. Broton, Ahreum Min, Michelle L. Pantoya & Ralf I. Kaiser, Oxidation of Levitated exo-Tetrahydrodicyclopentadiene Droplets Doped with Aluminum Nanoparticles, *J. Phys. Chem. Lett.*, **2019**, *10*, 5756-5763.

최명룡 교수

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